Vanquishing Vampires

Genomic analysis of predatory bacteria stands to improve the future of biofuels.

Floating together in a vast artificial pond, millions of vibrant green algae represent a bright future—one with an abundance of sustainable vehicles fueled by the oil these tiny organisms produce. Lurking below, however, vampire-like bacteria threaten to destroy the algae by sucking out their juicy insides. *Vampirovibrio chlorellavorus* are predatory bacteria, discovered in 1972, that specifically target algae in the *Chlorella* genus, which happen to be some of the best-suited algae for growth as a biofuel feedstock.

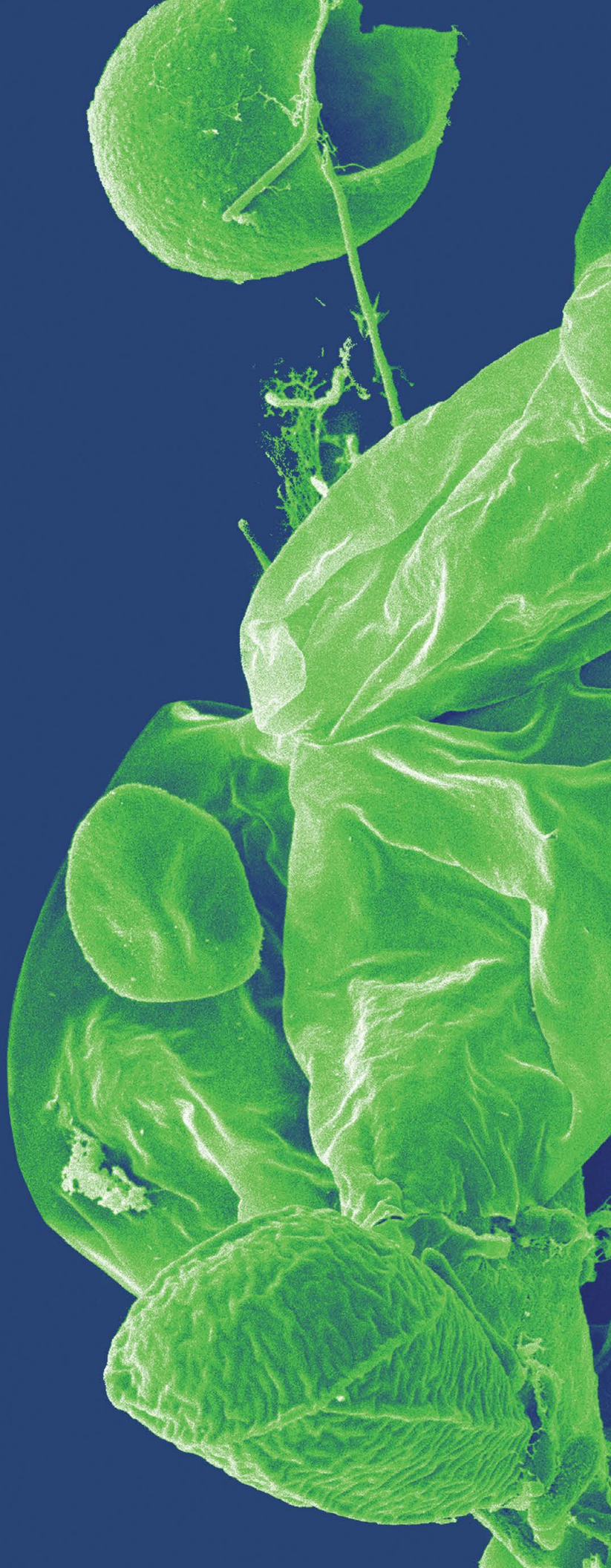
Although *V. chlorellavorus* can be eliminated using biocide chemicals or acids in order to save the algae, scientists at Los Alamos and the University of Arizona are studying their bacterial genomes to better understand how these and other pests may threaten algae ponds in the future. Recent analyses suggest that there may be multiple species of *Vampirovibrio* that prey on *Chlorella*. Furthermore, it is unknown if these new species or strains respond to the known treatments, and if they don't, well, for biofuel scientists, that might be like finding vampires who are not repelled by garlic.

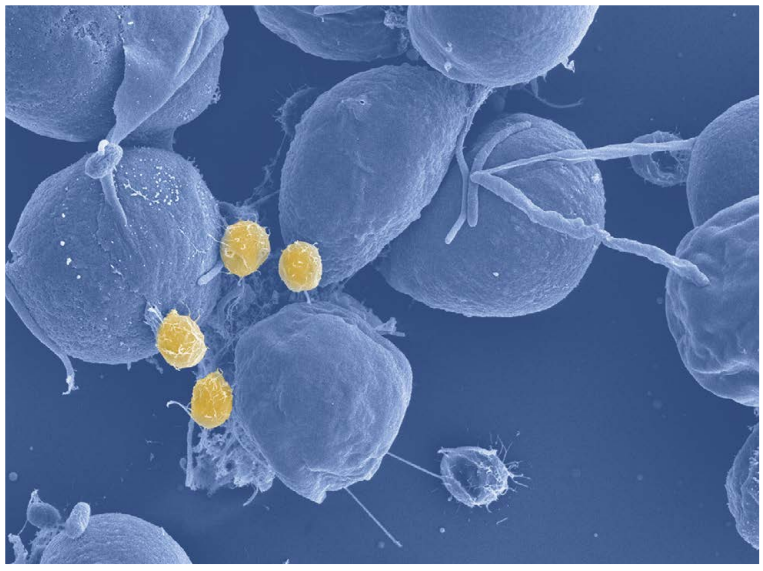
"We're just scratching the surface here," explains biologist Blake Hovde. "As we move algae production outdoors to be more economically feasible, there will be additional unknown pests out there. We need a standard way to identify them so they can be removed quickly."

Hovde and his team at Los Alamos have been evaluating the genomes of these invasive bacteria by isolating them from pond samples collected by collaborators at the University of Arizona. The analysis includes identifying organisms that harbor known virulence and pathogenicity genes, but it also includes discovering new genes that cause disease in algae, which may help the researchers identify new organisms of concern. They have also been studying a bacterial pathogen that targets *Nannochloropsis*, which is another genus of algae favored for biofuel production.

Identification of these specific gene targets allows the Los Alamos team to develop primers, which are small sections of DNA that can be used to target that same gene in a new sample. Ultimately, the Los Alamos team is developing a standardized way for algae farmers to test their ponds on a daily basis using field-ready equipment coupled with a set of primers that target all known predatory organisms. Rapid, specific detection of the exact threat will enable farmers to respond with the appropriate treatment quickly before it's too late.

—Rebecca McDonald





(Inset) *Vampirovibrio* bacteria (small yellow spheres) have attached themselves to *Chlorella* algae (large cells) and are ready to harvest their insides.

(Full page) Attack aftermath: The remnants of destroyed *Chlorella* algae cells along with a few remaining bacteria.

CREDIT: Seth Steichen and Judy Brown/University of Arizona